



STC04IE170HP

Monolithic emitter switched bipolar transistor
ESBT[®] 1700 V - 4 A - 0.17 Ω

Features

| $V_{CS(ON)}$ | I_C | $R_{CS(ON)}$ |
|--------------|-------|--------------|
| 0.7 V | 4 A | 0.17 Ω |

- High voltage / high current cascode configuration
- Low equivalent ON resistance
- Very fast-switch, up to 150 kHz
- Squared RBSOA, up to 1700 V
- Very low C_{ISS} driven by $R_G = 47 \Omega$
- Very low turn-off cross over time

Application

- Aux SMPS for three-phase mains

Description

The STC04IE170HP is manufactured in Monolithic ESBT technology, aimed at providing the best performance in high frequency / high voltage applications. It is designed for use in gate driven based topologies.

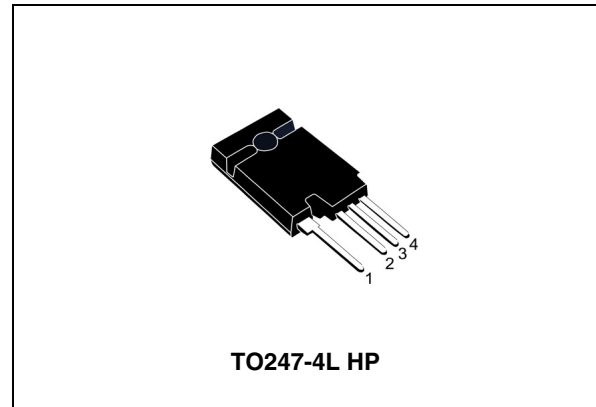


Figure 1. Internal schematic diagrams

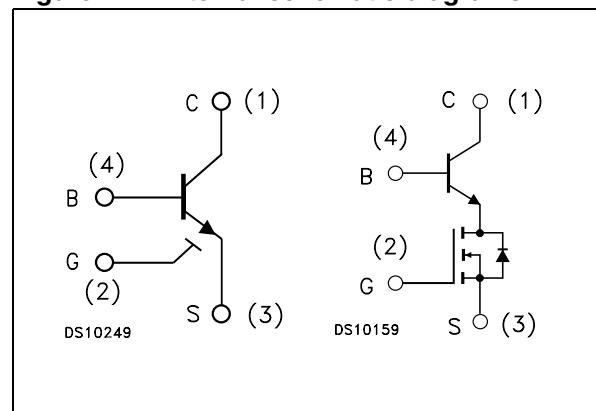


Table 1. Device summary

| Order code | Marking | Package | Packing |
|--------------|------------|-------------|---------|
| STC04IE170HP | C04IE170HP | TO247-4L HP | Tube |

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|--------------|--|------------|------------------|
| $V_{CS(SS)}$ | Collector-source voltage ($V_{BS} = V_{GS} = 0$) | 1700 | V |
| $V_{BS(OS)}$ | Base-source voltage ($I_C = 0, V_{GS} = 0$) | 30 | V |
| $V_{SB(OS)}$ | Source-base voltage ($I_C = 0, V_{GS} = 0$) | 17 | V |
| V_{GS} | Gate-source voltage | ± 17 | V |
| I_C | Collector current | 4 | A |
| I_{CM} | Collector peak current ($t_p < 5$ ms) | 8 | A |
| I_B | Base current | 4 | A |
| I_{BM} | Base peak current ($t_p < 1$ ms) | 8 | A |
| P_{tot} | Total dissipation at $T_c \leq 25^\circ\text{C}$ | 50 | W |
| T_{stg} | Storage temperature | -40 to 150 | $^\circ\text{C}$ |
| T_J | Max. operating junction temperature | 150 | $^\circ\text{C}$ |

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|----------------------------------|-------|--------------------|
| R_{thJC} | Thermal resistance junction-case | 2.5 | $^\circ\text{C/W}$ |

2 Electrical characteristics

($T_{\text{case}} = 25\text{ °C}$ unless otherwise specified)

Table 4. Electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------------|--|--|--------|------------|------------|---------------|
| $I_{\text{CS(SS)}}$ | Collector cut-off current ($V_{\text{BS}} = V_{\text{GS}} = 0$) | $V_{\text{CS}} = 1700\text{ V}$ | | | 100 | μA |
| $I_{\text{BS(OS)}}$ | Base cut-off current ($I_{\text{C}} = 0, V_{\text{GS}} = 0$) | $V_{\text{BS}} = 30\text{ V}$ | | | 10 | μA |
| $I_{\text{SB(OS)}}$ | Source cut-off current ($I_{\text{C}} = 0, V_{\text{GS}} = 0$) | $V_{\text{SB}} = 17\text{ V}$ | | | 100 | μA |
| $I_{\text{GS(OS)}}$ | Gate-source leakage current ($V_{\text{BS}} = 0$) | $V_{\text{GS}} = \pm 17\text{ V}$ | | | 100 | nA |
| $V_{\text{CS(ON)}}$ | Collector-source ON voltage | $V_{\text{GS}} = 10\text{ V } I_{\text{C}} = 4\text{ A } I_{\text{B}} = 0.8\text{ A}$ $V_{\text{GS}} = 10\text{ V } I_{\text{C}} = 1.5\text{ A } I_{\text{B}} = 0.15\text{ A}$ | | 0.7 0.6 | 1.5 1.4 | V V |
| $h_{\text{FE}}^{(1)}$ | DC current gain | $V_{\text{CS}} = 1\text{ V } V_{\text{GS}} = 10\text{ V } I_{\text{C}} = 4\text{ A}$ $V_{\text{CS}} = 1\text{ V } V_{\text{GS}} = 10\text{ V } I_{\text{C}} = 1.5\text{ A}$ | 4 7 | 5.5 11 | | |
| $V_{\text{BS(ON)}}$ | Base-source ON voltage | $V_{\text{GS}} = 10\text{ V } I_{\text{C}} = 4\text{ A } I_{\text{B}} = 0.8\text{ A}$ $V_{\text{GS}} = 10\text{ V } I_{\text{C}} = 1.5\text{ A } I_{\text{B}} = 0.15\text{ A}$ | | 1.3 0.9 | 1.5 1.1 | V V |
| $V_{\text{GS(th)}}$ | Gate threshold voltage | $V_{\text{BS}} = V_{\text{GS}} \quad I_{\text{B}} = 250\text{ }\mu\text{A}$ | 2 | 3 | 4 | V |
| C_{iss} | Input capacitance ($V_{\text{GS}} = V_{\text{CB}} = 0$) | $V_{\text{CS}} = 25\text{ V } f = 1\text{ MHz}$ | | 510 | | pF |
| $Q_{\text{GS(tot)}}$ | Gate-source charge ($V_{\text{CB}} = 0$) | $V_{\text{GS}} = 10\text{ V}$ | | 3.9 | | nC |
| t_{s} t_{f} | Inductive load Storage time Fall time | $V_{\text{GS}} = 10\text{ V} \quad R_{\text{G}} = 47\text{ }\Omega$ $V_{\text{Clamp}} = 1360\text{ V} \quad t_{\text{p}} = 4\text{ }\mu\text{s}$ $I_{\text{C}} = 2\text{ A} \quad I_{\text{B}} = 0.4\text{ A}$ | | 770 10 | | ns ns |
| t_{s} t_{f} | Inductive load Storage time Fall time | $V_{\text{GS}} = 10\text{ V} \quad R_{\text{G}} = 47\text{ }\Omega$ $V_{\text{Clamp}} = 1360\text{ V} \quad t_{\text{p}} = 4\text{ }\mu\text{s}$ $I_{\text{C}} = 2\text{ A} \quad I_{\text{B}} = 0.2\text{ A}$ | | 410 10 | | ns ns |
| $V_{\text{CS(dyn)}}$ | Collector-source dynamic voltage (0.5 μs) | $V_{\text{CC}} = V_{\text{Clamp}} = 400\text{ V}$ $V_{\text{GS}} = 10\text{ V} \quad I_{\text{C}} = 1.5\text{ A}$ $I_{\text{B}} = 0.3\text{ A} \quad t_{\text{peak}} = 500\text{ ns}$ $R_{\text{G}} = 47\text{ }\Omega \quad I_{\text{Bpeak}} = 3\text{ A } (2 I_{\text{C}})$ | | 5.36 | | V |
| $V_{\text{CS(dyn)}}$ | Collector-source dynamic voltage (1 μs) | $V_{\text{CC}} = V_{\text{Clamp}} = 400\text{ V}$ $V_{\text{GS}} = 10\text{ V} \quad I_{\text{C}} = 1.5\text{ A}$ $I_{\text{B}} = 0.3\text{ A} \quad t_{\text{peak}} = 500\text{ ns}$ $R_{\text{G}} = 47\text{ }\Omega \quad I_{\text{Bpeak}} = 3\text{ A } (2 I_{\text{C}})$ | | 4.32 | | V |
| V_{CSW} | Maximum collector- source voltage at turn- off without snubber | $R_{\text{G}} = 47\text{ }\Omega \quad h_{\text{FE}} = 5 \quad I_{\text{C}} = 4\text{ A}$ | 1700 | | | V |

1. Pulsed duration = 300 μs , duty cycle $\leq 1.5\%$.

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

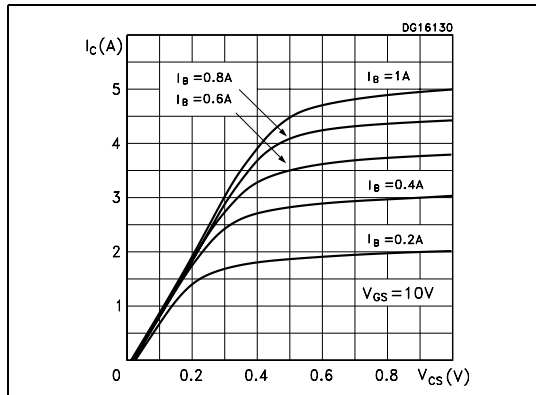


Figure 3. Collector-source dynamic voltage

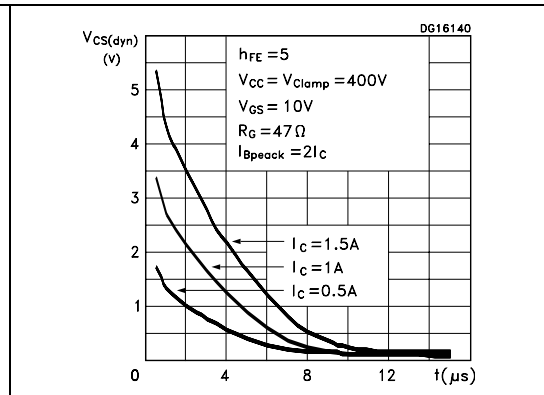


Figure 4. DC current gain

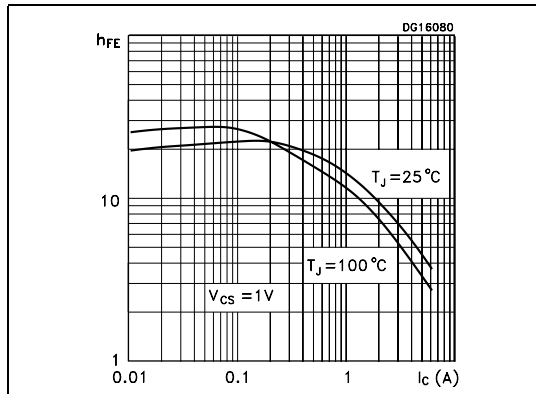


Figure 5. Gate threshold voltage vs temperature

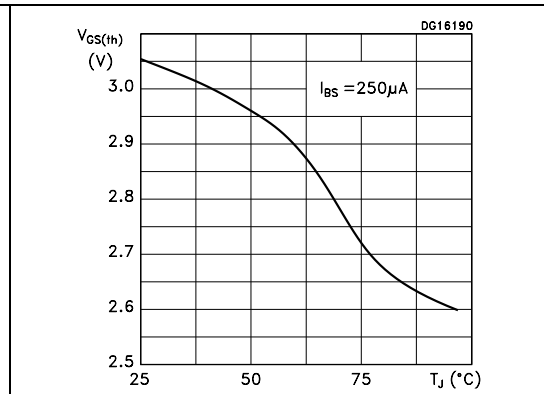


Figure 6. Collector-source ON voltage ($h_{FE} = 5$)

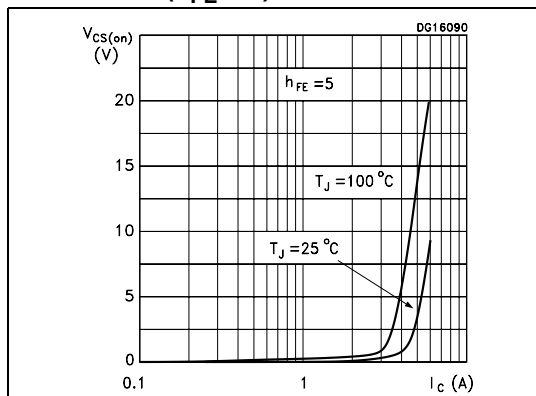


Figure 7. Collector-source ON voltage ($h_{FE} = 10$)

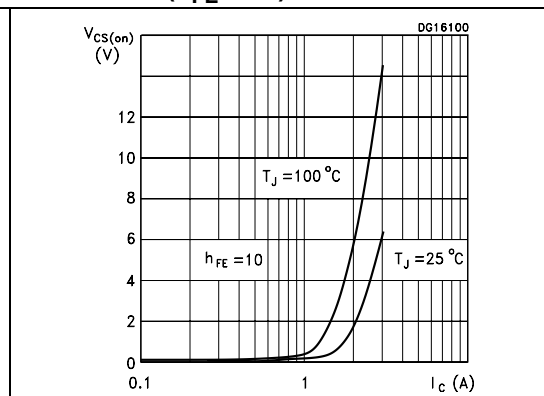


Figure 8. Base-source ON voltage ($h_{FE} = 5$)

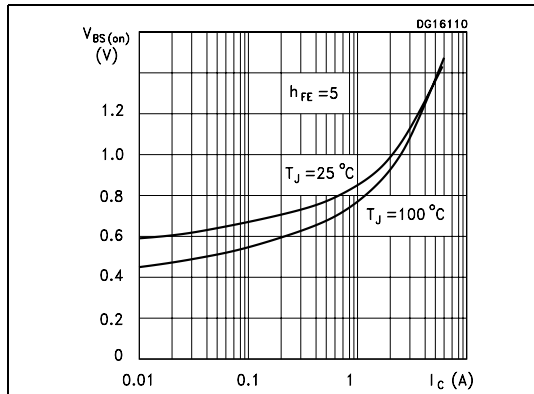


Figure 9. Base-source ON voltage ($h_{FE} = 10$)

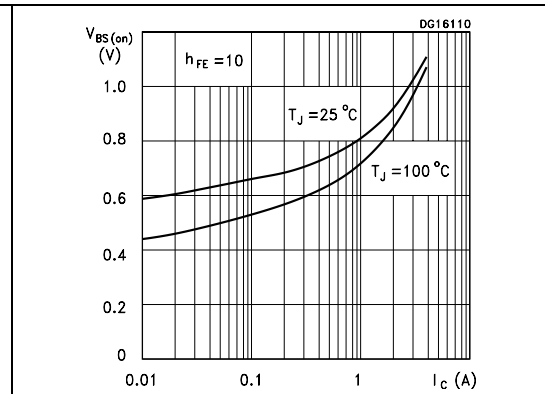


Figure 10. Inductive load switching time ($h_{FE} = 5$)

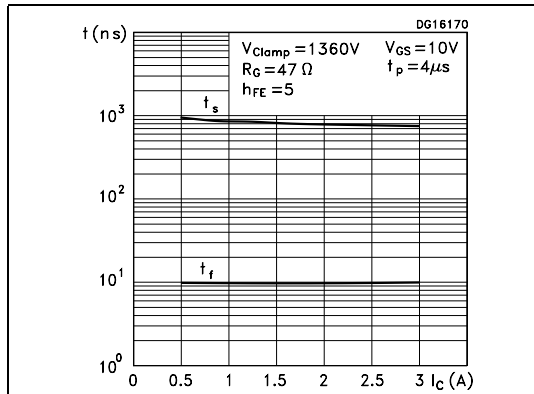


Figure 11. Inductive load switching time ($h_{FE} = 10$)

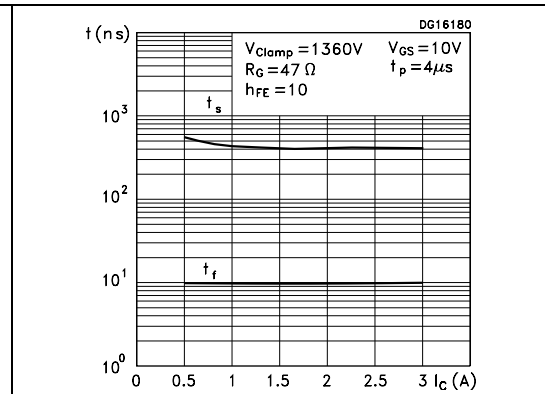
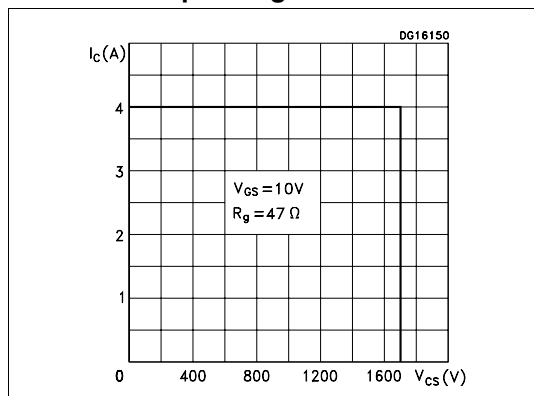


Figure 12. Reverse biased safe operating area

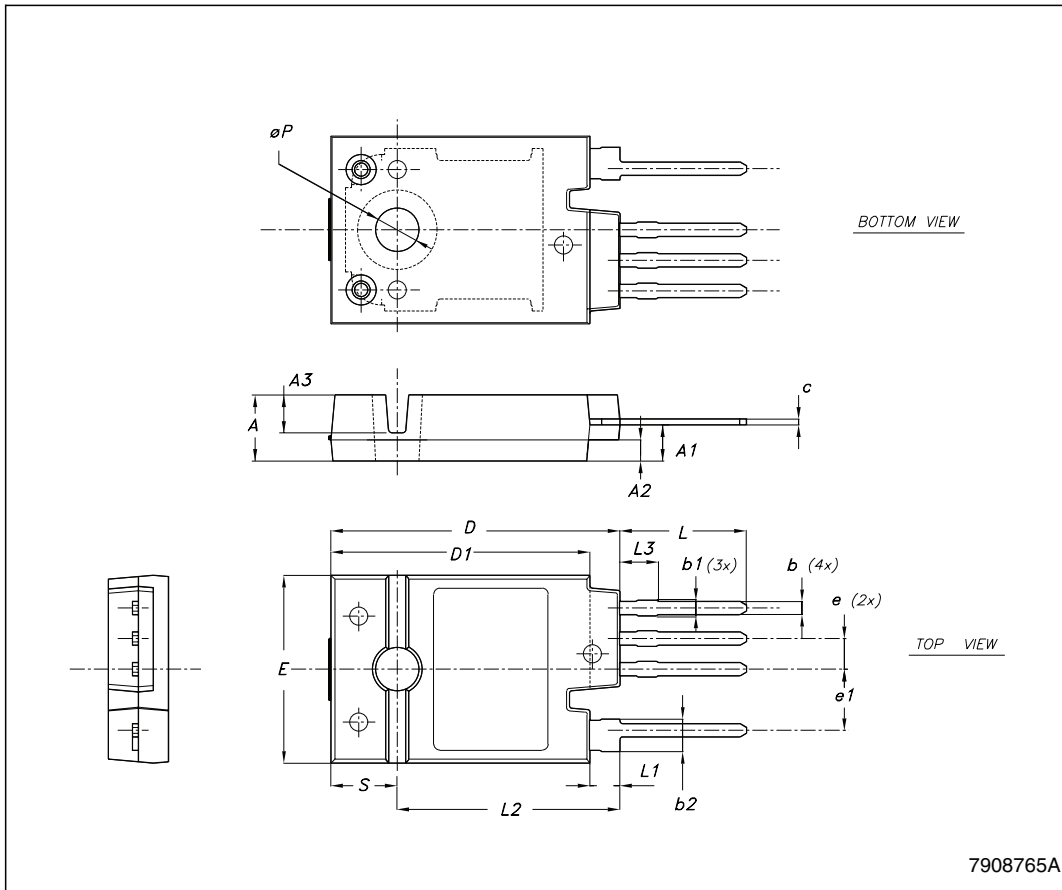


3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK[®] is an ST trademark.

TO247-4L HP mechanical data

| DIM. | mm. | | |
|------|-------|-------|-------|
| | MIN. | TYP | MAX. |
| A | 5.50 | 5.65 | 5.80 |
| A1 | 2.85 | 3.15 | 3.25 |
| A2 | | 1.92 | |
| A3 | | 3.18 | |
| b | 0.95 | 1.10 | 1.30 |
| b1 | 1.10 | | 1.50 |
| b2 | 2.50 | | 2.90 |
| c | 0.40 | | 0.80 |
| D | 23.85 | 24 | 24.15 |
| D1 | | 21.50 | |
| E | 15.45 | 15.60 | 15.75 |
| e | | 2.54 | |
| e1 | | 5.08 | |
| L | 10.20 | | 10.80 |
| L1 | 2.20 | 2.50 | 2.80 |
| L2 | | 18.50 | |
| L3 | | 3 | |
| øP | 3.55 | | 3.65 |
| S | | 5.50 | |



4 Revision history

Table 5. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 27-Sep-2006 | 1 | First release. |
| 21-Nov-2006 | 2 | Improved application target. |
| 17-Jun-2009 | 3 | Updated Figure 2 on page 4 and mechanical data. |

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